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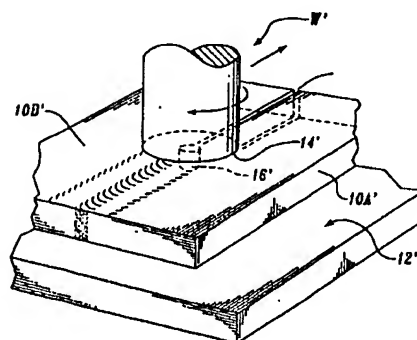
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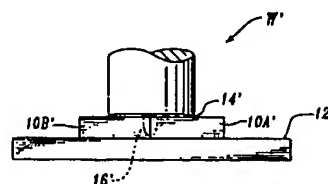
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(54) Friction stir welding with simultaneous cooling

(57) A method and apparatus for friction stir welding that produces a weld of significantly reduced surface roughness at significantly higher welding rates, in materials that are difficult to weld, such as non-extrudable aluminum alloys. The method includes cooling the stir welding tool during the welding process, thereby reducing the tendency of softened metal to adhere to the rotating pin and shoulder of the tool. The apparatus includes a tool with internal spaces or an external jacket, through which coolant can be pumped to remove heat and cool the tool during welding operations. In another embodiment, the apparatus includes a device for spraying a coolant onto exterior surfaces of the distal end of the welding tool to thereby remove heat from the tool, and the surrounding workpiece, during welding.



(Prior Art)
Fig. 1A



(Prior Art)
Fig. 1B

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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	WO 93 10935 A (WELDING INST) 10 June 1993 ---	1-13	B23K26/12 B29C65/06
D,A	WO 95 26254 A (NORSK HYDRO AS ;MIDLING OLE TERJE (NO); MORLEY EDWARD JAMES (NO);) 5 October 1995 ---	1-13	
A	DAWES C J ET AL: "FRICTION STIR PROCESS WELDS ALUMINUM ALLOYS" 1 March 1996 , WELDING JOURNAL INCLUDING: WELDING RESEARCH, VOL. 75, NR. 3, PAGE(S) 41 - 45 XP000587301 * the whole document *	1-13	
P,X	GB 2 306 366 A (WELDING INST) 7 May 1997 * page 7, line 1 - line 8 * * page 17, line 25 - line 32 * -----	1,4-6,11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B23K B29C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 7 October 1998	Examiner Haegeman, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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